

*Demetriida picea*.

*Demetriida picea*, Chaud. Bull. Mosc. 1848, i. p. 77; Ann. Soc. Ent. Belg. tome xv. p. 195 (1872).

*Cymindis australis*, Hombr. & Jacq. Voy. Pôle Sud, Zool. t. i. f. 7 (1842?).

*Cymindis Dieffenbachii*, White, Dieffenb. New Zeal. vol. ii. p. 273 (1843); Blanch. Voy. Pôle Sud, Zool. iv. (1853).

Christchurch (Mr. Fereday).

Chaudoir's name must remain for this species, according to the rule that the first unoccupied name accompanied by a description takes the priority. The figure in the 'Voyage au Pôle Sud' was published eleven years before the description, and was erroneously lettered *C. australis*, not being the *C. australis* of Dejean. Blanchard himself corrected this error in 1853; but long before that date Chaudoir's excellent description had appeared. White's name was simply given (without description) to the above-mentioned figure, in place of the erroneous *C. australis*.

*Species of doubtful position.*

*Pedalopia novæ zelandiæ*, Castelnau, l. c. p. 154.

XXXVI.—*Remarks on Mr. H. J. Carter's Letter to Prof. King on the Structure of the so-called Eozoon canadense.* By WILLIAM B. CARPENTER, M.D., LL.D., F.R.S., Corresponding Member of the Institute of France.

THE well-merited reputation which Mr. Carter has gained by his researches on *Sponges* and *Foraminifera* will doubtless give to his decided expression of opinion *against* the Foraminiferal character of the (so-called) *Eozoon canadense* a very considerable weight with those naturalists who regard the question as still *sub judice*.

Had Mr. Carter (whose additions to our knowledge of the minute structure of certain types of Foraminifera are estimated by no one more highly than by myself) pronounced this opinion after a careful study of what has been written *in favour* of the Foraminiferal character of *Eozoon*, and after an examination of the *pièces justificatives* therein referred to, I should have respected it, however different from my own, as that of an able investigator who has the fullest right both to form and to publish his judgment, and should not have troubled the scientific public with any further discussion of the question at issue.

But that the readers of Mr. Carter's letter may form a right estimate of the value of his *pronunciamento*, they ought to be aware of the following facts:—

1. Mr. Carter, as I learn from himself, has not read any thing that has been written upon the opposite side of the question.

2. Mr. Carter's ideas of Foraminiferal structure are based, not upon a comprehensive survey of the entire group, but upon that of the small number of types he has himself examined. This is clear from the fact that his definitions (pp. 191, 192) apply only to a certain section of the *Vitreous* or "perforate" Order, and exclude the *Porcellanous* and the *Arenaceous* Orders—the first of them uniformly "imperforate," the second generally so.

3. Mr. Carter's knowledge of *Eozoon* is avowedly confined to that which he has derived from the examination of the specimens sent to him by Prof. King. If he had asked me to show him the chief results I obtained from a study of the large mass of material put into my hands by Sir Wm. Logan, which occupied nearly my whole time (during slow convalescence from a severe illness) for a space of two months, I should have most gladly done so; and I feel sure that I should at any rate have demonstrated to him that there is a great deal more to be said in favour of the Foraminiferal nature of *Eozoon* than he has at present any idea of.

Hence Mr. Carter's affirmation, that the opinion of those from whom he differs on this question has no other basis than "the wildest conjecture," and his imputation to them of incapacity to distinguish things as different from each other "as the legs of a table are from the legs of a quadruped," are to be considered simply as specimens of a new method and language, which, after Prof. Huxley\*, I may term *Carterese*. Whether its general adoption will be good for the progress of Science, may be an open question: I will give an example of its application.

Geologists who have worked over the Greensand near Cambridge, have met with spherical bodies varying from the size of a marble to that of a small cricket-ball; which, I learn from Prof. Ramsay, they were accustomed to kick about as inorganic concretions, without the smallest idea of their organic origin. The discovery by Prof. Morris, however, of a non-infiltrated specimen, led me to examine the internal structure of these solid balls; and this examination brought me to the knowledge of the *entirely new* and, in many particulars, *ano-*

\* "To call a man an Atheist, in *Recordese*, simply means that you don't agree with him."

*malous* type of Foraminiferal structure, formed by the cementation of sand-grains in concentric spheres, which I have described under the name *Parkeria* (Phil. Trans. 1869). But as this type does not happen to conform to Mr. Carter's pre-conception of a Foraminifer, and as he might examine one or more of the silicified balls without finding any indication of organic structure, the principle on which he has acted in regard to *Eozoon* would justify him in asserting that nothing but the "wildest conjecture" could make it out to be Foraminiferal, for that "its structure does not bear so much resemblance to that of a foraminiferous test as the legs of a table to those of a quadruped." Now it so happens that every conclusion I had drawn from the careful study of the *best-preserved* specimens of *Parkeria* has been fully confirmed, and its anomalies explained, by the discovery, in our Deep-sea dredgings, of a *living* Arenaceous Foraminifer (with the animal in it), whose structure conforms, in all essential particulars, to that of *Parkeria*. I may fairly, then, apply Mr. Carter's words to *his own* method, and say that, "if such be the grounds on which geological inferences are established, the sooner they are abandoned the better for geology, the worse for sensationalism."

Those whose knowledge of Foraminifera ranges over the *entire group* as at present known, have the most unlimited belief in its "possibilities;" and it has thus come to pass that they accept the Foraminiferal character of the *Eozoon*, on the basis of the large number of *parallelisms* which its structure presents to that of existing types, notwithstanding some *differences*, which they regard as comparatively non-essential.

To say nothing of my *collaborateurs*, Mr. W. K. Parker, Prof. T. Rupert Jones, and Mr. H. B. Brady, whose opinions may be thought to have been personally influenced by my own, I may cite the judgment recently given by the late Prof. Max Schultze not long before his lamented death, as that of an entirely unprejudiced and fully competent "third party," whose opinion even Mr. Carter is bound to respect, on account not only of his well-known profound mastery of Zoology generally, but of his *special* knowledge of Foraminifera—his admirable Treatise 'Ueber den Organismus der Polythalamien' having been referred to in my 'Introduction to the Study of the Foraminifera' (1862) as "among the most important of recent contributions to our knowledge of the organization and life-history" of the group. In the spring of last year, Prof. Schultze requested me to send him some specimens of *Eozoon*, in order that he might form his own judgment of its nature, at the same time stating the general opinion among German

geologists to be adverse to its organic character. In response, I forwarded to him two specimens—one a transparent section taken from the same block as that which furnished the section examined by Mr. Carter, the other a decalcified slice. Subsequently, at his request, I sent him the largest specimen of *Eozoon* I could spare *en bloc*, that he might make preparations for himself. The result of his examination of these specimens was *to satisfy him completely* of the Foraminiferal character of *Eozoon* \*. This conclusion was formed without any “verbal arguments” or “prolonged disputations,” but on the basis of Prof. Schultze’s own “actual comparison of specimens” of *Eozoon* with specimens of recent Foraminifera—the former showing the very structures which Mr. Carter could *not* find in the specimens he examined, and the latter exhibiting those precise parallelisms which the recent types referred to by Mr. Carter do *not* furnish.

I shall now briefly state what these parallelisms are.

1. Large masses of rock occur in the Laurentians of Canada, in which there is a very regular alternation of lamellæ of Carbonate of Lime (sometimes replaced by Dolomite) with lamellæ of Serpentine or some other Magnesian Silicate, often to the number of fifty or more. For this alternation, such eminent Petrologists as Dr. Sterry Hunt and Mr. Sorby have expressed their inability to account on any known principles of Mineralogical formation; on the other hand, it becomes perfectly intelligible when we view the calcareous lamellæ as having been successively formed by the growth of a Foraminiferal shell, and the serpentinous lamellæ as having been subsequently produced by the replacement of the sarcodic body which occupied its cavities by a deposit of serpentine or some other silicate; for such replacement *is going on at the present time*, so as to furnish us with internal casts of various *Foraminifera* brought up by dredging from the ordinary sea-bottom—these internal casts giving us (when the calcareous shell is dissolved away by dilute acid) the perfect models, not merely of the segments of the sarcodic body, but also of the sarcodic ramifications of the canal-system, and even, in some instances, of the sarcodic threads filling the minute tubuli of the shell-wall. Even so, when the calcareous lamellæ of *Eozoon*

\* Referring to the sections I had sent him, Prof. Max Schultze said, in a letter dated Aug. 16, 1873, “Some points are very difficult to settle; but the organic structure cannot be doubtful.” And after making his own investigation on the piece I had subsequently sent to him, he said, in a letter dated Nov. 15, 1873, “In the last number of the ‘Comptes Rendus’ of the Association of Wiesbaden, I gave a short extract of my researches on *Eozoon*, quite accordant with yours.” A translation of this report will be found in p. 324.

have been dissolved away, we have such a Serpentinous fabric as is represented in fig. 1; in which we recognize those general features of conformity to the Foraminiferal type which

Fig. 1.

Structure of *Eozoon canadense*.

were first pointed out by Professor Ehrenberg as exhibited in the Green-sands of various Geological periods, with details which accord most remarkably with those of particular types.

2. Although, in its indefinite zoophytic mode of growth, *Eozoon* differed from the *Nummulites* and *Orbitoides* to which Mr. Carter refers, yet it agrees with *Polytrema*\*, a type which was formerly described as a Millepore, but which I have shown to be a wildly-growing Rotalian. Further, in its imperfect segmentation, only interrupted occasionally by a complete chamber-partition, it agrees with *Carpenteria*†, another Rotalian; my description of which, as of the preceding, and my references to them in my account of *Eozoon*, it is of course only consistent in Mr. Carter to ignore, on his principle of not reading any thing on the other side.

3. The general plan of the Calcareous fabric, as we should see it if we could dissolve out the Serpentine, is shown in fig. 2, which was constructed from sections in my possession by the conscientious and intelligent draughtsman Mr. George West, to whom I was indebted for those admirable constructive representations of various types of recent *Foraminifera* whose accuracy no one has ever challenged‡. This shows the suc-

\* Introduction to the Study of Foraminifera, p. 235.

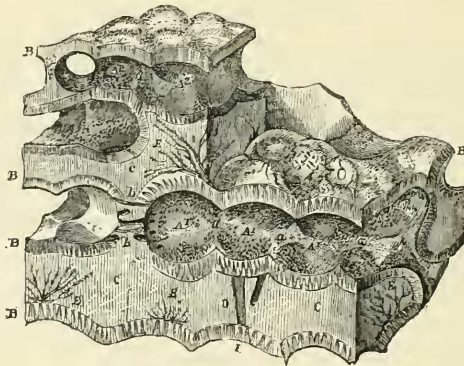
† *Op. cit.* p. 186.

‡ A most remarkable proof of this accuracy was afforded by the fact that Mr. G. West's reconstruction of the complicated canal-system of *Polystomella* ('Introduction to the Study of the Foraminifera,' pl. xvi. fig. 1) was made four years before I obtained the internal cast (fig. 9), which verified it to the minutest particular.



cessive stories of chambers ( $A^1 A^1, A^2 A^2$ ), the chambers of one story usually opening into one another like apartments *en suite*, but being occasionally divided by complete septa traversed by passages, as at *b b*. Each chamber is enclosed in a chamber-wall, *BB*, which, when well preserved, alike in sections and in internal casts, exhibits a fine nummuline tubulation, generally perpendicular in its direction, but frequently presenting exactly those varieties which I have figured and described in the tubulation of the recent *Operculina*. I freely admit that there are two anomalies in the arrangement of this tubulated chamber-wall:—first, that it covers the floor, resting on the preformed intermediate skeleton, as well as forms the ceiling; and, second, that its tubulation is sometimes horizontal. But looking to the wonderful variability of the Foraminiferal type, and the number of the parallelisms exhibited in the calcareous structure here represented to the known

Fig. 2.

Structure of *Eozoon canadense*.

forms of Foraminiferal organization, I ask whether, in the face of the continual discovery of far more strange anomalies (as in the case of *Parkeria*), these entitle any one to affirm that this structure is a mere pseudomorph. If the accuracy of that representation is questioned or denied, I have simply to say that I can prove it to any one who will examine the preparations in my possession.

4. The "intermediate skeleton" (fig. 2, *c c*) precisely corresponds in its disposition, and in the distribution of the canal-system (*E*) which traverses its thicker layers, with the intermediate skeleton of *Calcarina*, another type fully elucidated by me, to which Mr. Carter makes no reference; and there is this further very curious correspondence—that the

canal-system originates, not directly from the chambers, but, as in *Calcarina*, from a set of sinuses *outside* the tubulated chamber-wall. Now Mr. Carter seems to suppose that Dr. Dawson, and all those who agree with him in this identification (which Dr. Dawson first made by comparison with specimens of *Calcarina* he had received from myself), have been so "green" as never to have thought of the probability that the so-called canal-system may be nothing else than dendrites of glauconite. This hypothesis has from the first been present to our minds, as Mr. Carter would have seen if he had read the memoirs which he has thought fit to ignore. And, not to mention other reasons, I may state two, which perfectly satisfy Mr. Sorby (the most eminent authority on micro-mineralogy) that they cannot be thus accounted for. First, these dendrites usually pass *directly across* the cleavage-planes of the calcareous shell, between which, if they were infiltrations, they would be almost certain to spread. Second (and this is, to my mind, still more conclusive), that minuter part of the canalicular system which is only to be discerned in the very transparent calcite by a careful management of the light (and which Mr. Carter has obviously not recognized), is *not infiltrated with any foreign mineral* at all; but is simply filled up with calcite, disposed in the same crystalline axis with that of the shell itself, as is the case in the consolidated calcareous network of the fossil spines of *Echinida*, the stems of *Crinoidea*, and the like. An experience of thirty-five years, extending over a wide range of Micro-palæontological inquiry, has given me, I venture to think, some special aptitude for recognizing Organic structure when I see it; and I never saw, in any fossil whatever, more distinct evidences of organic structure, than are to be seen in these finer ramifications of the canal-system of *Eozoon*, which are far more distinct than is the tubulation of any but the best-preserved fossil Nummulites.

I do not pretend to affirm that the doctrine of the Foraminiferal nature of *Eozoon* can be *proved* in the demonstrative sense. But I do affirm that the *convergence of a number of separate and independent probabilities*, all accordant with that hypothesis, while a separate explanation must be invented for each of them on any other hypothesis, gives it that *high probability* on which we rest in the ordinary affairs of life, in the verdicts of juries, and in the interpretation of Geological phenomena generally.

To any one who calls in question the evidentiary facts I have adduced, I simply say "Come and see." I cannot be

expected to trust out of my possession valuable preparations, which, if lost or injured, I might never be able to replace. But I am quite willing to give time and trouble to enable those who wish to make the "comparison of the actual specimens" for themselves, to do so, without any "verbal arguments" or "prolonged disputations."

If the so-called *Eozoon* be really an Organic structure, whether Foraminiferal or any thing else, it is time that it should be generally acknowledged as such. But if it can be shown to be a Mineral pseudomorph, I quite agree with Mr. Carter that the sooner it is exploded as a sham, the better it will be for Geology. I trust that my scientific career has given sufficient evidence of my having "loved truth better than system," to justify my assertion that I shall be quite ready to surrender it, if I can be proved to be mistaken (as I have been before now) by the examination of my own specimens, and that I shall even thank any one who will set me right. No one, however, of the many eminent scientific men who *have* examined and compared these specimens, has as yet pointed out to me any error in my interpretation of the appearances they present; and nearly all of them have expressed their unreserved acceptance of it.

### XXXVII.—*On the Arrangement of Sponges.*

By Dr. J. E. GRAY, F.R.S. &c.

I PROPOSED an arrangement of sponges in the 'Proc. Zool. Soc.' 1867, p. 502, of which I suggested a modification in the 'Ann. & Mag. Nat. Hist.' 1868, i. p. 165, and 1872, ix. p. 440, and especially in a paper which I wrote on the division of the spicules of sponges into types (Ann. & Mag. Nat. Hist. 1873, xii. p. 203).

The continued study of the structure of sponges and of their spicules has induced me to propose an alteration in their arrangement, as a sequel to the last quoted paper, which I believe will make it more natural and facilitate their study.

I would divide the Porifera, or sponges, into four orders :—

Order I. ARENOSPONGIA (Ann. & Mag. Nat. Hist. 1872, ix. p. 448, enlarged). The sponges strengthened by particles of sand, fragments of spicules, and other siliceous bodies, which they collect from the sea.

Order II. THALASSOSPONGIA (Ann. & Mag. Nat. Hist. 1872,